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Exchange of experience on standards and guidelines to improve significantly energy efficiency in buildings

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Background paper on main findings of the study on mapping of energy efficiency standards in buildings in the ECE region

Note by the secretariat

I. Background information

1. The Committee on Sustainable Energy and the Committee on Housing and Land Management established the Joint Task Force on Energy Efficiency Standards in Buildings in 2015. In 2017–2018, projects in support of implementation of tasks by the Joint Task Force are funded by the Governments of Denmark and the Russian Federation and by the Black Sea Economic Cooperation Organization (BSEC). One of the implemented activities of the Joint Task Force is a study on mapping of energy efficiency standards in buildings in the United Nations Economic Commission for Europe (ECE) region.

2. The study was carried out from November 2017 to July 2018 and was discussed, reviewed, and validated during the first and second meetings of the Joint Task Force, respectively in Geneva on 1 November 2017 and in Yerevan, Armenia on 14–15 April 2018. This document presents the main findings of the study.

3. Existing building energy standards in the ECE region vary from voluntary guidelines to mandatory requirements, which may apply to one or many building types. Their development is typically a complex decision-making process that can involve several stakeholders. Building energy standards are difficult to classify and the standards that are

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stringent for one country may be ineffective in another country, depending on climate conditions, occupant behaviour, existing building stock, and construction practices.

4. A decision to develop a study on mapping of existing energy efficiency standards and technologies in buildings in the ECE region was made in response to these challenges and for a better understanding of the status of deployment and implementation of energy efficiency standards in buildings in the ECE region.

5. The objectives of this study are to identify which energy efficiency standards in buildings the ECE member States are using and also to evaluate the most effective policies and highlight the best practices to help countries learn from each other and achieve greater savings. The study provides a snapshot of the legal status and coverage of building energy standards in 56 member States and lays out the status of their stringency, technical requirements, enforcement and compliance, and use of energy efficient building materials and products in selected countries of the ECE region. It highlights some national best practices for the above elements. With the exception of a few countries, all countries have now embedded regulations for newly constructed and renovated residential and non-residential buildings.

II. Methodology

6. The study was carried out in four inter-related steps: data collection on the status of energy efficiency standards and technologies in buildings in the ECE region using a survey, complemented by desktop research and stakeholder consultations; analysis of the survey results; gap analysis of the building energy codes effectiveness; and initial assessment of energy efficient technologies in buildings in relation to the existing standards.

7. The analysis of the survey results was carried out for the ECE region with disaggregation by the sub-regions:

A. European Union (EU) Member States prior to 2004 (EU15)[1], Norway, and Switzerland;

B. EU enlargement - the 13 countries that joined the EU after 2004 (EU13)[2];

C. Eastern Europe, the Caucasus, Central Asia, and the Russian Federation[3];

D. North America[4]; and

E. South-Eastern Europe[5].

8. The following countries were not included in this study due to the lack of information available: Cyprus, Malta, Iceland, Liechtenstein, Andorra, Monaco, San Marino, Israel and Turkey.

9. Data collected from the survey responses was complemented by the results of the online research of already published documents. It was analyzed and presented in a tabular form for selected countries from all sub-regions across individual metrics to provide a comparative gap analysis of energy efficiency standards in buildings in the ECE region.

[1] Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom.

[2] Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia.

[3] Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Republic of Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.

[4] Canada and United States.

[5] Albania, Bosnia and Herzegovina, Montenegro, Serbia, and the former Yugoslav Republic of Macedonia.

This analysis also includes case studies and highlights the best practices in countries from different sub-regions.

III. Main findings

10. The analysis of the coverage and stringency of building energy codes across the ECE region indicates that some countries still apply building energy codes only to specific types of buildings, such as single- or multifamily buildings in the residential sector. For example, Azerbaijan and Kazakhstan do not currently have provisions to cover single-family buildings. Building energy codes in Georgia cover only new residential buildings while in the Republic of Moldova they cover only existing residential and commercial buildings.

11. It has been noted that while many member States have now technical requirements in place in their building energy codes, there is still a small number of countries which are yet to implement requirements on heating, cooling, lighting and ventilation.

12. The results of the gap analysis also pointed to a large disparity between the Energy Performance Certification (EPC) implementation across the ECE member States, with sub-region C lagging behind on the use, stringency and coverage, as well as the quality and monitoring of the EPC. A number of responses and some published studies have indicated that the quality of the EPC is not satisfactory in some countries. There are also some inconsistencies across the ECE member States on the choice and design of the assessment methodology which hinders the EPC implementation process. The successful implementation of the EPC is also constrained by a lack of enforcement, training and monitoring mechanisms. In Albania, Belarus, Georgia, Kazakhstan, and the former Yugoslav Republic of Macedonia, the EPC is not used.

13. The results of the survey have indicated also a lack of knowledge, inconsistencies in statistics and a lack of appropriate studies related to the energy performance gap. This suggests one or more of the following issues: the calculation methods are flawed, the enforcement regime is not being undertaken sufficiently rigorously, or designers and builders are failing to satisfactorily deliver the outcome intended. Closing the energy performance gap between design intent (and regulatory requirement) and the actual performance is likely to become an important issue over the next decade if countries are to deliver the climate and environmental targets related to buildings. In Switzerland, for example, this is currently being researched, with initial findings suggesting a 30-300 percent gap measured compared to predicted energy performance in residential buildings. Albania reports that there is a 30-40 percent energy performance gap, while the former Yugoslav Republic of Macedonia reports that energy performance gap is not currently recorded and only predicted/calculated energy performance is being used.

14. The gap analysis also suggests that compliance and enforcement of building energy codes are being undertaken with less rigor and attention to detail in some countries. Specific incentives and enforcement mechanisms are currently not widely used in building energy codes in countries in sub-region C. Azerbaijan, Albania, Belarus, Croatia, Kazakhstan, Montenegro, Republic of Moldova, Russian Federation, Serbia, Turkmenistan, and Ukraine do not have provisions for incentives for improving compliance in their building energy codes.

15. Although most of the countries have now inspection schemes for boilers and/or air conditioning systems, data collection on the number of inspections done by each member State is still at a very low level. Insufficient data makes it difficult to make proper assessment of the effectiveness of these schemes. A number of countries, e.g. Finland,

France, Ireland, the Netherlands, Slovenia, Sweden, and the United Kingdom do not include requirements for inspection of boilers.

16. Some countries still show a low level of implementation of requirements for the use of energy efficient materials and products, with some countries being more stringent than others when it comes to materials certification and testing. A number of countries from sub-regions C and E, e.g. Albania, Georgia, Republic of Moldova, Turkmenistan, Ukraine, and the former Yugoslav Republic of Macedonia, show a relatively low level of implementation for this metric, while other countries, e.g. Bosnia and Herzegovina, Kazakhstan, Montenegro, the Russian Federation, Serbia, and Uzbekistan, include requirements for the use of certified energy efficiency materials and products in their building energy codes.

17. A preliminary analysis of deployment of energy efficient technologies in countries of the ECE region demonstrates that a number of countries has achieved significant progress, resulting from a holistic and consistent policy approach to developing and implementing building energy codes with the support of effective financial and enforcement mechanisms. A significant improvement has been noted in increasing energy efficiency of heating and cooling equipment in many countries, however, market maturity for high-priority building envelope components varies significantly between the countries of the ECE region.

18. Many countries, particularly countries of sub-region C, still have difficulties in increasing the deployment of energy efficient technologies in the market. This may stem from the wrong signals sent by incoherent polices on financial incentives, lack of consumer awareness of the benefits of such technologies, insufficiently developed building energy codes, and lack of technical expertise, all of which have negative impacts on the energy efficient technology cost reduction, ease of installation and market conditioning.

IV. Recommendations

19. *Recommendation 1:* ECE member States should continue the process of harmonization of building energy codes by ensuring comprehensive coverage of all types of buildings[6] in their regulations.

20. *Recommendation 2:* ECE member States should lay down the necessary measures to include a national energy efficiency target, based either on primary or final energy consumption, or on primary or final energy savings, or on energy intensity.

21. *Recommendation 3:* ECE member States, to continue the process of harmonization through further strengthening the requirements for insulation, ventilation and technical installations, should:

(a) Give more attention to air-tightness of the envelope;

(b) Ensure inclusion of the requirements for air conditioning, lighting, active solar, renewables and natural lighting;

(c) Make mandatory the requirement for the inspection of boilers and air-conditioning systems to improve the quality and precision of Energy Performance Certificates in collective dwellings;

[6] Includes new and existing residential and non-residential buildings, single family, apartments, commercial and public buildings.

(d) Follow a holistic approach in building energy codes based on overall building performance, including requirements for technical systems such as heating, ventilation, and air conditioning (HVAC) and lighting.

22. *Recommendation 4:* ECE member States should consider introducing or strengthening quality assurance measures, especially during the early stage of the certification process:

(a) The requirements for the qualified experts should be harmonized across the countries of the ECE region;

(b) The certifier needs to be physically present onsite;

(c) There is a need to further harmonize the quality check of the EPC;

(d) Facilitate harmonization of the EPC through integration of ventilation, cooling and lighting into the certificate; and

(e) Need for guidance in development of the centralized EPC databases and digitalization of the EPC process.

23. *Recommendation 5:* ECE member States should consider making the challenges of the energy performance gap in existing buildings and data collection on actual energy use to be a priority area for research in the respective country.

24. *Recommendation 6:* ECE member States should establish or strengthen proper (electronic) monitoring systems of compliance, enforcement and quality control processes through the qualified experts to ensure compliance with building energy codes and standards.

25. *Recommendation 7:* ECE member States should lay down the necessary measures to establish a regular inspection of boilers and air conditioning systems in building energy regulations.

26. *Recommendation 8*: ECE member States should lay down the necessary measures to continuously monitor, analyse, and adjust energy usage in building energy codes.

27. *Recommendation 9:* ECE member States, particularly countries with economies in transition, should consider creating incentives for improving energy efficiency through appropriate policies, tax incentives and low-interest loans for energy efficiency projects.

28. *Recommendation 10:* ECE member States should introduce the necessary measures in building energy codes to facilitate the process of harmonization of energy efficient materials and products testing and certification using best practices employed by other countries of the ECE region. When developing and harmonizing building energy codes in lower-middle income economies of the ECE region, regard should be given to the types of construction that these countries can afford. This will ensure that building energy codes effectively promote production of local traditional materials, research and development for improving local traditional techniques, materials testing, and quality control, and do not create dependency on imported building materials that may stifle local innovation.

29. *Recommendation 11:* ECE member States should introduce the necessary measures in building regulations to ensure that the materials and products used in construction are subject to rigorous quality control processes to meet the requirements for energy efficiency while maintaining robust combustion performance, fire resistance test, and seismic resistance, ensuring they do not cause threat to the safety of people and property.

30. *Recommendation 12:* ECE member States should consider funding collaborative international research to assist in the establishment of new harmonized building materials

test mechanisms and to ensure that independent organizations beyond the manufacturing community can play a key role in developing market-neutral procedures.

31. *Recommendation 13:*

(a) ECE member States, particularly countries with economies in transition, should consider improving transparency in information access and exchange by making full-featured versions of their building energy codes accessible and available free of charge with the applicable calculation methods on the relevant websites;

(b) ECE member States, especially neighbouring countries who have already developed their building energy codes in detail and are at the stage of their practical implementation with real positive effects, should provide methodological assistance and other types of assistance to countries in need of such development;

(c) ECE member States, particularly countries with economies in transition, should consider developing common approaches to building energy codes reflecting specifics of energy exporting and energy importing countries.

32. *Recommendation 14:* ECE member States should introduce the necessary policies based on well-founded identification of the energy efficient technology options that can best assist national energy objectives and carry out an in-depth review of economic and non-economic barriers to progress as a baseline for future policies in their respective countries.

33. *Recommendation 15:* ECE member States, particularly countries with economies in transition, should introduce the necessary policies to increase awareness and understanding of the national and local authorities, property developers, and national and international financial institutions about the feasibility of significant investments in EE technologies.

34. *Recommendation 16:* ECE member States, particularly countries with economies in transition, should introduce the necessary policies to educate government officials at the national and municipal levels on the business environment necessary to attract investments in energy efficiency in buildings and how to translate private sector requirements into effective policy measures and/or government initiatives.

35. *Recommendation 17:* ECE member States should introduce the necessary policies to facilitate the deployment of energy efficient technologies in the market place by improving coherence of the programmes for energy efficient technologies and other government policies to meet public policy goals.